Perceptual and Motor Skills, 2001, 93, 435-450. © Perceptual and Motor Skills 2001

GEOPHYSICAL VARIABLES AND BEHAVIOR: XCVI. "EXPERIENCES" ATTRIBUTED TO CHRIST AND MARY AT MARMORA, ONTARIO, CANADA MAY HAVE BEEN CONSEQUENCES OF ENVIRONMENTAL ELECTROMAGNETIC STIMULATION: IMPLICATIONS FOR RELIGIOUS MOVEMENTS[1]

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Summary.—Since the year 1992 individuals and groups of people have reported religious experiences near Marmora, Ontario, Canada. The experiences, attributed to Christ or Mary, have occurred near the top of a hill adjacent to an open pit magnetite mine that has been accumulating about 15 million gallons of water per month for more than a decade. During the period between 1992 and 1997 epicentres for local seismic events moved significantly closer to this site. Most of the messages attributed to spiritual beings by "sensitive" individuals occurred one or two days after increased global geomagnetic activity. We suggest that conditions produced by local geophysical and geological properties created the odd lights and induced physiological changes within the thousands of people who visited the area. Direct measurements indicated that weak (0.1 microTesla to 1 microTesla) complex magnetic fields, the temporal patterns of which were similar to the experimental fields we have employed to evoke the sensed presence and altered states within the laboratory, may have been generated within the area.

Anomalous natural events, when attributed to religious causes, have been followed by significant social movements and have been employed as rationalizations for political decisions (Persinger & Lafreniere, 1977) that frequently involve the elimination of competitive groups. A classic historical example was the belief by Constantine who reported odd lights in the sky. He perceived them as a Christian cross, a symbol by which he would conquer the known world. During the 1960s, the appearance of luminous phenomena over a church in Zeitoun, Egypt (Derr & Persinger, 1989) was attributed to the perceiver's god and considered an adumbration of victory.

During the 1990s, near Marmora, Ontario (77.7 W, 44.3 N), a quiet socioreligious movement began that was allegedly initiated by the reported appearances of Roman Catholic symbols, Mary and Christ. They were experienced within more or less the same small area within a larger region associated with aboriginal histories of "sacred places" and unusual luminous dis-

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plays. The area exhibits specific geological and geophysical properties. The phenomena and location were considered optimal to explore the possibility of a natural explanation for these events.

General Description of the Tectonic Strain Theory

The Tectonic Strain Theory (TST) states that most anomalous luminous events are associated with the transients or temporal derivatives associated with forces generated by tectonic strain induced by stresses within the local crust of the earth (Persinger, 1990). The energies responsible for the observed phenomena are focused within narrow areas in the order of 1 m-sq. to 100 m-sq. and for brief durations in the order of 1 to 100 sec. The interstimulus interval can be within the range of ksec. to Msec. This local tectonic strain is usually produced by increased hydrological loads. They include changing levels of water within rivers, reservoirs, lakes, or dams (Persinger & Derr, 1990; Derr & Persinger, 1993), or injections of fluids into bedrock (Derr & Persinger, 1990a, 1990b). Far-field stresses, inferred by the occurrence of proximal earthquakes (within about 200 km, depending upon the geology) can produce aseismic temporal gradients in strain that enhance the focal strength of the field (Persinger & Derr, 1993).

The specific characteristics of the phenomena, such as their spatial localization, would be influenced by the composition of the local geology and the geometric features of the topography (Persinger, 1984). For example, most unusual luminous phenomena are observed over apices (tops of hills) that can accumulate electric charge or near technologies, such as microwave corridors or power lines, that significantly alter the configurations of extremely low frequency magnetic fields and the strength of the earth's static magnetic field. The presence of piezoelectric material within the local rock encourages electrical anomalies and diffuse photic displays while the presence of conductive sulfides within the local rock increases the probability of unusual smells, such as methylsulfonamide, or local fluctuations in temperature.

Because these localized transients of energy are associated with significant, complex electromagnetic fields, the immersion of sensitive individuals within these patterns could encourage coherence of cerebral activity that evoke experiences that appear "real" (Persinger & Koren, 2001). We have found that weak, frequency-modulated and burst-firing magnetic fields produced within the laboratory can produce a range of mystical experiences (Persinger, 2000). The details of the experiences would be shaped by the regions of the brain that are activated and the cultural labels or verbal expectancies by which they can be categorized (Persinger, 1983).

Individuals who display temporal lobe sensitivity (Persinger & Makarec, 1993), as inferred by significantly elevated scores for clusters of experiences

that are associated with neuroelectrical activity within the limbic system (Roberts, Gorman, Lee, Hines, Richardson, Riggle, & Varney, 1992), have been shown to be responsive to these environmental fields (Cook & Persinger, 2001). The moderate strength of associations between suggestibility and complex partial epileptic-like signs (Persinger, 1994) also indicates these experiences and their explanations of these experiences in these contexts would be strongly influenced by expectancy and belief.

Although the occurrence of the geophysical conditions that produce the transients that evoke the exogenous physical phenomena (and the changes within the observer's brain) that generate meaningful experiences would not be continuous, these conditions would be persistent over decades or centuries (Devereaux, 1989). Consequently, many of the areas that display these strong anomalies should have rich histories of comparable phenomena, however they have been interpreted from the perspectives of the culture and its intrinsic beliefs (Persinger, 1985).

The Marmora Site

Most of the phenomena have occurred within the boundaries of a farm that is located between Marmora and Deloro, Ontario. The farm is located about 2 km east of Marmora, on the right side of Highway 7 towards Deloro. Crowe Lake is about 4 km west of the farm, and several dams (of the Crowe River) are between the lake and the farm. An old gold mine, from which large quantities of arsenic were extracted to manufacture pesticides, is within 10 km of the farm. The mine, which has been considered one of the most contaminated in the province, was later filled with radioactive refuse from a nuclear plant. Childhood leukemia in this area has been considered elevated by local residents.

The farm's property is proximal to an open pit iron ore (magnetite) mine within which the water has been rising since the mine was closed in March, 1978. The estimated rate of water accumulation, from underground springs, is 1,600 liters per min. At this rate, the asymptote should occur in the year 2009 at which time there should be 23 billion liters (23 billion kg) of water in the pit.

The primary area on the farm within which the "observations" and "auditory messages" have occurred is approximately 100 m in diameter. Before the first major occurrence of the phenomena during 1992, stations of the cross (a ritual associated with Roman Catholic traditions) had been erected. Most of the phenomena have occurred near the apex of a hill, now associated with Stations 10, 11, and 14. This smaller region, within which many of the experiences have been reported, is immediately adjacent (within 20 m) to a commercial microwave (cellular phone) tower which was erected shortly (approximately June, 1990) before the phenomena began. The open pit mine is about one km southwest of the communication tower.

Marmora Area and History

The town of Marmora is adjacent to the Crowe River. The town is located in Hastings County. Magnetite was mined in the area as early as 1820. These ironworks (furnaces) were abandoned in 1875. A Catholic church, constructed in 1825, was the first of these structures built for this religion in Ontario. In addition to the expected local stories concerning spirits and ghosts near an old cemetery (within 1 km of a river) Petroglyph Provincial Park is 17 km west to northwest of the Marmora site. The park contains hundreds of symbolic shapes and figures that were carved upon a flat expanse of marble between 500 and 1,000 years ago. The petroglyphs are considered a sacred site by Ojibwa Anishinabe natives who call it "the rocks that teach" although the alternative translation is "the rocks that talk."

Geology of the Ore Deposit

The Marmora magnetite deposit was within a belt of Grenville metasediments composed of crystalline limestone, amphibolies, granite-gneiss, and quartzite gneiss that were intruded by rocks of the gabbro-anorthosite-diorite group, later by granite and syenite, and finally by diabase dykes (Gross, 1967). The deposit, first detected by an aeromagnetic survey in 1949, one of the first concentrations to be detected by this method, was covered by about 38 m of Palaeozoic limestone. The anomalous zone, located about 2 km southeast of the village of Marmora, was elliptical (1 km by 0.75 km). The major axis (strike) was north to northwest with a dip of 60° west.

Data from drill-hole patterns indicated the ore zone extended at least to a depth of 230 m. According to aeromagnetic measurements the resultant static geomagnetic field intensities outside of the anomaly were about 600 nT (nanoTesla) while the centroid of the ore body was 8500 nT. Crystalline limestone was predominant on the east side of the deposit while a large mass of diorite rock occurred on the southwest side of the ore zone.

The ore deposit consisted of a number of long sinuous, magnetite-rich zones, 15 m to 30 m wide. The zones (or lenses) were approximately parallel with the strike and dip of the metasediments and formed tabular to lenticular masses of as much as 120 m thick and 760 m long. Most of the rock, especially in the eastern side of the deposit, contained medium to fine grained dark green pyroxene and amphibole. A large portion of sulphide minerals appears to have occurred after the introduction of the magnetite. The zone had been deformed by fracturing and shearing and some portions showed brecciation. One shear, that strikes northeast (and passes through the farm on which the phenomena occur), sectioned the magnetite-bearing skarn and syenite.

Mining of the Ore and Consequences

Beginning in March, 1952, to obtain the ore (35% magnetite), 20 mil-

lion tons of (limestone) rock were removed during a three-year period. When the pit was about 40 m deep, during 1958 a "rockburst" occurred and generated a pile of debris approximately 3 m high in the deepest portion of the pit. In addition to the removal of the limestone cap, the company removed about 40 million kg of ore and redistributed about 28 billion kg of rock around the pit. Originally the executives of the mining company had planned to excavate to 225 m, i.e., 100 ft. below sea level, along 14 progressively constricting volumes, but they stopped at 5 m below sea level.

Once under the limestone cap, the accumulating water became more and more difficult to remove. When water began filling the pit as the digging exceeded sea level, complications resulted in abandonment of further efforts. The mine was closed March, 1978. Since that time the water level was 70 m above sea level in September 1985 and 104 m above sea level in March 1990. The water level in April 1997, the time of this field study, was 131 m.

The Beginning of the Phenomena

The owners of the farm, an elderly couple, are Roman Catholics. The father had experienced "great meaning" when he had read (about 1990) of the sightings of Mary ("Blessed Mother," "Our Lady") in Medjugorje, Yugoslavia. During 1991, the couple visited Medjugorje. The father reported he experienced a miracle when the sun turned green. After returning from Yugoslavia, the owner built the fourteen stations of the cross and dedicated his farm to spirituality. They were in place for the tenth anniversary (24 June, 1991) of the Medjugorje sightings.

The first primary experiences were reported during the year 1992, although there may have been anomalous phenomena that emerged during the latter part of 1990. The first major reported apparitions by three different "seers" were 25 June, and 27 July (Station 10), and 23 August (Station 11), 1992. On 13 September, 1992, a fourth seer claimed to see the apparition. The primary experiences involved auditory messages attributed to Mary or to Christ. The experient was usually surrounded by several people. The other most common report was the perception of glows around the rocks. A few photographs, taken near some of the key stations, showed poorly formed, longitudinal streaks of light. Occasionally a silver rosary darkened. The explanation was that it had turned from silver to gold. These phenomena have been intermittent.

A major event occurred on 8 December, 1994 when about 10,000 people moved through the area. The message was given to a seer (D.T.) at the tenth station. At that time people reported a covering of the sun such that they could perceive the color spectrum. "Golden" glows were described around people walking within the proximal environment. Some individuals, including children, reported "entities," of various heights, described as angels. Some saw crucifixion scenes of Jesus while others saw Mary in the sun.

A Brief Sample of the "Global" Messages

Like the Fatima (Portugal) and Medjugorje (Yugoslavia) phenomena, the primary themes of the messages have been apocalyptic and reminiscent of the early stages of most revitalization movements. The original "messages," beginning in 1992 included phrases attributed to Jesus such as "My children, listen to me, repent! Come to me your true saviour! Hurry! The time is near and you shall regret your faults. . . . I am asking you to pray for peace in Bosnia and in the world." Those attributed to Mary, especially by 1994, included instructions such as "At the fourteenth station you will feel the glory of Christ. I love you and I bless you. . . . Ask for Jesus' grace and he will help you too. Please little ones, continue praying. Always pray and also pray for Pope John Paul II and always support him. . . . Canada will suffer much. Continue praying for your country." By 1996, the messages included "there will be a sign before April, 1998 that everyone will see . . . the end is near."

Recent Phenomena and Measurements

Interviews with local residents by the first author during late 1997 as well as the information published by the owners of the farm have indicated developments consistent with the predictions from the Tectonic Strain Theory. The area around Marmora has been described as exhibiting some of the most violent local thunderstorms that have been observed. Reception from radio stations, particularly within about 2 km of the farm, has been variable. Intermittent power failures and "line surges" have been reported.

Unusual colored clouds, such as pinkish green or greenish-yellow instead of the usual dark-grey or black, have been observed before electrical storms. An amateur astronomer reported "blue" lights during the summer of 1996. Within a length of about 1.5 km of road that passes the farm, several fatal and near-miss motor vehicle accidents have occurred. Many of the people who visit the site appear "stunned" or confused when they drive from the site.

There have been several tens of thousands of visitors to the site. To accommodate the visitors, a large parking lot and public facilities was built. Approximately three books have been written, primarily by a Roman Catholic nun who had been the senior administrator of a general hospital, about the "miracle at Marmora". One of the daughters of the couple who owned the farm died in June, 1995 due to complications from breast cancer. About two days before the death, while the daughter was comatose in a hospital, an experient at the site received a message that reduced the family's grief.

The primary experients were women. Most of the experients have reported (1) auditory messages, (2) apparitions (that others cannot see) such as Christ on a cross or Mary smiling down upon the experient but without

"messages," or (3) feeling "the presence" when they are on the site. The first of the four major experients developed tumours of the lower limbs that required surgical intervention. There was a second group of experients, composed of men and women, who, after experiencing phenomena on the Marmora site, also reported presences and auditory information elsewhere. Most experiences distal to the site occurred when the percipient was alone or meditating.

One of the most vocal experients (D.T.) was a woman from Japan. She compared the experiences to "dream-like" phenomena. She concluded that Jesus spoke to her directly. Proselytization for "conversion of the heart" was the primary instruction. Most of the messages were delivered while she was lacrimating. Less vocal experients, of whom there may have been several dozen, reported messages that were either idiosyncratic (personal religious conversions) or of vague global relevance.

Observations of Videotapes of the Experients

Real-time measurements of videotapes (*Gift of God Marmora*, Camon Inc., Montreal, 1996) suggested that the duration of the experiences by the "seers" were in the order of 100 sec. Antecedents included repetition of prayers before leaving the farm house area, singing (religious chants) as groups of people move through the stations until they reached the tenth position, and prayers and forelimb rituals (crossing). One experient (D.T.) displayed lip movements, head nods, and substantial lacrimation. The average time between five sequential episodes of head nods and lip movements was 22 sec. (range 18 through 24 sec.). During these periods others fell prostrate and displayed bilateral finger clonus. The experients who remained prostrate vocalized "messages" usually associated with facial grimaces.

On Site Measurements of Mine

Direct measurements were completed by the first author with a Metex M–3800 digital multimeter and sensor (Electric Field Measurement, W. Stockbridge, MA 01266) during April, 1997. The magnetite of the proximal surface and intrusive rocks were sufficient to attract and maintain small magnets with intensities of a few gauss. Direct measurements using a power frequency sensor showed continuous variations between 1 sec. and 7 sec., with a median of 4 sec. The intensities ranged between less than 10 nT (threshold of sensor) to 950 nT (9.5 milligauss) even though there were no obvious 60-Hz sources such as power lines. These fluctuations were evident even when the sensor was mechanically stable.

During the measurements, the first author experienced a sharp sensation on the chest. The following day a triangular-shaped, erythemic patch (about 3 cm maximum width) was evident on the skin above the breast in an area that a metallic medallion had been apposed. The burn was photo-

graphed. The lesion required about two months to disappear. Interestingly, during this period personal distress or sleep disruptions intensified the coloration of the skin where the lesion had been.

The Site of the Phenomena

Except for the religious artifacts near the farmhouse and strong contextual cues from the parking area to the beginning of the stations, the area was not unusual. The stations were distributed along a crude perimeter of the farm. There were no unusual rock formations in any of the initial stations. The incline up the hill began around Station 4. Stations 10, 11, and 14 were littered with rocks and quartzite outcrops. The outcrops were sufficient to attract and hold small bar magnets. The area below the microwave tower (cellular phone), situated between Stations 10 and 11, was associated with power frequency field strengths of between 60 nT and 100 nT. However, compared to these values and to the values of stations before 10, which could achieve values of 40 nT, the values within the higher stations never exceeded 10 nT.

Geomagnetic Activity and Experiences

Three of the seers, V.D., D.T., and A.N. (all women) had at least five separate episodes. The dates and details had been published by the owners of the site. Repeated measure multivariate analyses of variance (Persinger, 1993) were completed for the geomagnetic activity, as inferred by global aa (average antipodal) indices (Mayaud, 1973), for each of the three days before, the day of, and each of the three days after the experiences on the site. There were statistically significant differences in geomagnetic activity during these periods for the latter two women ($F_{6,24} = 2.53$, $p < .05$; $\eta^2 = 39\%$; $F_{6,36} = 2.70$, $p < .05$; $\eta^2 = 31\%$).

Post hoc (paired t tests) indicated that the days of the experiences displayed significantly less activity than the two and three days before the experience. The means and standard deviations for the aa values for the two women were 15.6 (*SD*: 7.5) and 22.0 (*SD*: 9.5) for the experience days and 27.8 (*SD*: 9.2) and 43.7 (*SD*: 14.1) for the second and third days (averaged) before the experiences.

Earthquake Activity and Analyses

According to the Southern Ontario Earthquake Survey, the numbers of epicenters of discernable seismic events (threshold about magnitude 0) near Marmora increased significantly ($r = .40$) between January 1990 and December 1997. As seen in Table 1, epicenters were located less than 100 km from the site in 1993; an epicenter less than 50 km from the site occurred in 1997. The closest epicenters from the years 1990 through 1997 were at distances of 288 km, 217 km, 226 km, 95 km, 56 km, 58 km, 61 km, and 46 km, respectively.

TABLE 1
NUMBERS OF EPICENTERS AS A FUNCTION OF DISTANCE (IN KM) FROM MARMORA BETWEEN YEARS 1990 THROUGH 1997

Year	0 to 50 km	51 to 100 km	101 to 200 km	201 to 300 km
1990	–	–	–	2
1991	–	–	–	2
1992	–	–	–	2
1993	–	1	2	5
1994	–	1	3	1
1995	–	–	3	7
1996	–	2	4	9
1997	1	6	8	6

If the optimal conditions for the focus of the forces associated with transients of tectonic strain had been emerging within Marmora between 1990 and 1997, then the monthly numbers of experiences on the site should have been associated with the occurrence of regional stress release, as inferred by the occurrence of seismic events. To test this hypothesis, the numbers of major Marian experiences per month from January 1994 through August, 1996 were loaded into our computer files. There were a total of 22 events. The monthly range was between 0 and 4. For comparison, the numbers of "visitations" that occurred away from the site by experients, which only began to occur in 1995, were also collected.

The monthly aa values and the numbers of earthquakes occurring within 200 km ($n=2$), between 201 and 300 km ($n=4$), and between 301 and 400 km ($n=7$), were extracted from our seismological data obtained from the United States Geological Survey. The major cluster of the experiences at the Marmora site began the same month (March, 1994) as one of the only two quakes that occurred within 200 km during the 32 months employed in the analyses. The proportion change in monthly aa values (calculated as the difference between the aa value of the previous month and the month divided by the value for the month) was calculated. All analyses involved SPSS and employed techniques published previously (Derr & Persinger, 1989, 1990b).

Symmetrical lag/lead analysis (± 2 months) was completed for the numbers of experiences. The independent variables were the two lags and leads and key (zero lag) values for earthquakes and for proportion of change in geomagnetic activity ($n=10$ variables). The results of the lag/lead analyses indicated that 61% of the variance (multiple $R=.80$) in numbers of experiences per month reported on site in Marmora could be accommodated by the occurrence of an earthquake within 200 km during the previous month and the proportional decreased geomagnetic activity (compared to the previous month) two months previously ($F_{2,25}=22.56$, $p<.001$). A separate analy-

sis, involving the same increments but including all of the numbers of seismic events (including those below magnitude 2.0) from the Southern Ontario Survey showed similar results.

Discussion

Reports of meaningful experiences attributed to religious or spiritual sources within specific areas have been reported cross culturally and historically. These manifestations are usually associated with regions of accumulation of tectonic strain or with unusual configurations of the local static geomagnetic field within which weak magnetic fields with complex temporal structures can emerge. The phenomena are usually near the apices of hills, topographically, or above subsurface structures arranged in these geometries (Persinger, 1985).

The emergence of such phenomena near Marmora, Ontario is consistent with the characteristics of a multitude of sites, such as in Conyers (Magnet), Georgia and Denver, Colorado, throughout the world. The site is adjacent to an abandoned open pit mine (also a geomagnetic anomaly) within which fluid has been accumulating at a rate of approximately 68 million liters (15 million gallons) per month. This volume is within the range that precipitated seismic instability around Derby, Colorado during the 1960s (Derr & Persinger, 1990a).

As the stress and strain continued to accumulate, aseismic propagation from local earthquake activity near (less than 300 km) Marmora would have been expected to modulate the strain release within this region. One would expect transient (decasec. to ksec.), localized (<10 m) manifestations that would have included electrical anomalies within conductors (silver rosaries), luminous displays or glows, or tissue blemishes from coronal effects of conductive jewellery apposed to the skin. The energy levels of some "glows" would be sufficient to influence photographs in a manner similar to those obtained within "haunted" areas (Roll & Persinger, 2001).

The probability that a larger area, surrounding the site and including the magnetite pit, may emit anomalous electromagnetic fields was suggested by the report of inconsistent radio reception within the area. The attenuated propagation and "noise" could be a function of the electrical anomalies generated by the accumulating fluid loads within the rock and would be encouraged by the transient geomagnetic anomalies created by global geomagnetic storms within buried conductors like magnetite (Porath & Dziewonski, 1971). The occurrence of "unusual colors" in the sky as well as the "blue luminosities" near the mine would be congruent with the types of luminous phenomena that have been described as Unidentified Flying Objects. According to the Tectonic Strain Hypothesis (Persinger, 1990), they are natural phenomena associated with increments of strain that occur intermittently before a nearby (within 300 km) seismic event.

The primary occurrences of the Marian messages near Stations 10, 11, and 14, that were located near the top of the hill, would facilitate the focus of weak, transient electromagnetic fields. Their pixel durations and temporal structure may have been similar to those known to produce experiences attributed to "apparitions" in natural (Persinger & Koren, 2001) and experimental (Persinger, Tiller, & Koren, 2000) settings.

The area within which the Marian experiences occurred was strewn with loose rocks and protrusions whose content of magnetite was sufficient to hold small bar magnets. The presence of the tallest metal conductor, a microwave tower, on this hill could have been a focus for strong electrostatic and magnetostatic fields. The diameter of the volume of these earth fields would be expected to exceed the height of the tower.

Electrostatic fields several 100 m in surface depth would be sufficient to orient particles within the air over the site, especially during windless, hazier days, and would allow the types of diffractions of light (Burke, 1986) that could be perceived as "multicolored" glows or sprites. The mixtures of specific wavelengths (colors, hues) would be determined by the modal distributions of widths and densities of the suspended atmospheric particles through which the normal sunlight was scattered. With sufficient particulate density, "direct viewing" of the solar disc might have been possible.

The site might be considered a functional equivalent to our experimental chamber within which the subject is exposed to complex magnetic fields, on the order of 1 microT, that are generated through the temporoparietal regions of the brain (Persinger, Richards, & Koren, 1997). In our experiments the "informational content" of the sequence is produced by computer software and generated by computers. The extent to which electromagnetic transients from the cellular telephone tower, which overshadows this area and was erected just before the phenomena escalated, have contributed to the events is not clear. However, if Budden's hypothesis (1994) is correct, then individuals exposed within the microwave corridor would be prone to experiences of apparitions. Elicitation by specific complex magnetic fields of apparitional experiences within sensitive, normal individuals may occur more frequently than assumed (Persinger, Tiller, & Koren, 2000).

The predicted effects of these fields upon the human observer in a natural setting have been described previously (Persinger, 1983, 1984). In summary, there would be three major factors that would affect the contents of the experiences. The first would be context. Because the site is now associated with spiritual themes, any experience would be attributed to the source and, thus, evoke the images and meanings associated with it. Considering the perceptual dominance of Roman Catholic symbols and artifacts, this theme should predominate.

The second factor would be the lability of the experients' (particularly

right) temporal lobes. This sensitivity generates two important components, suggestibility and responsivity to weak, complex magnetic fields. The first component would facilitate the group experiences of "miracles" such as altered perceptions of the sun or the occurrence of "angels" in the vicinity. The second component, electrical lability, would increase the likelihood that some of these individuals would report experiences that are similar to those generated experimentally. They have included the sensed presence (Cook & Persinger, 1997, 2001), vestibular sensations (of uplifting), weakness of the lower legs (or a sudden reluctance to move), visual patterns, and profound emotional experiences.

Experimentally, the probability of evoking a sensed presence has been greatest if the stimulation by the appropriate complex magnetic fields first occurred over the right hemisphere and then over both hemispheres. Two routine procedures within the Marmora site could have stimulated this functional asymmetry. The first would have been the practice of singing and chanting as groups of people walked slowly for several minutes towards the key areas on the top of the hill The second condition would have been the lateralization or cerebral asymmetry of neuroelectrical activity within the more sensitive individuals. We have found that, in general, right-handed women are more sensitive than right-handed men.

The behaviors displayed by the experients who "received messages" were not sufficient to conclude they were the observable correlates of electrical seizures. Clinically, many of these displays would have been more typical of nonepileptic seizures (Persinger, 1994). Approximately 30% of the seizures displayed by patients who exhibit verified epilepsy are considered nonepileptic seizures. Their occurrence does not exclude the existence of spatially constrained, paroxysmal activity within the orbitofrontal, parahippocampal gyral, insular, or amygdaloid regions. Unless these discharges access the dorsal or lateral cerebral cortices, their presence would not be discernable by classical electroencephalographic measurements.

A relationship between daily geomagnetic perturbations and the occurrence of the messages was evident for only two of the three of the most persistent experients. Their experiences occurred on days when the geomagnetic activity was significantly less intense than the previous days. A recent study (Long, O'Donovan, Cabe, Bennett, Whitington, Bell, & Persinger, 1996), involving patients with verified complex partial seizures, indicated such experiences were more frequent two to three days after an increase in geomagnetic activity. This pattern would be consistent with the explanation but not evidence that the neural processes within the experients at Marmora may be similar to those involved with verified complex partial seizures in hospitalized patients.

Our previous research has also indicated that individuals are more likely

to report experiences attributed to "telepathic" sources when the geomagnetic activity is lower than the days before or after the experiences (Persinger, 1993). Although these labels do not necessarily imply construct validity, the consistency of this geomagnetic relationship over decades suggests a common source of variance for which the controlling stimuli are not yet clear. If similar processes were occurring at Marmora, then the "information" experienced by the seers could have been more related to phenomena that have been labelled as psi experiences. Because the major themes of these experiences would have been more associated with right hemispheric processes, the content would have been very emotional, acquired primarily by incidental learning, and indicative of the relationship between the self-recognition and the social environment (Keenan, Wheeler, Gallup, & Pascual-Leone, 2000). Women would be more articulate given their greater interhemispheric coherence (Corsi-Cabera, Herrera, & Malvido, 1989). It might allow relatively more efficient translation of right hemispheric information into linguistic images.

Both the manifest content and syntax of the "messages," as reported by the experients, are predictable consequences of the linguistic style of Roman Catholic verbal rituals. Cultural periods associated with apprehension and the fragmentation of social (conduct) expectancies are frequently associated with portends of disaster. Within the last decade, Western culture has experienced a reduction in the stability of the precise modes of social interaction (particularly between men and women) and an escalating emotive anticipation of "the millennium." Admonitions to repent and return to the old teaching, a variant of "return to the past," minimizes anxiety because the past has already occurred (Persinger, 1987). Such anxiety reduction can be enhanced if the attribution of an anomalous event to a miracle is perceived as an intrinsic validity of the belief and hence "proof" of personal immortality.

The global themes of the "messages" by the experients at Marmora have reflected the contemporary concerns of the experients. The issues of Medjugorje, which preceded the Yugoslavian civil war, was the first thematic focus. During 1994, as the apprehension over the potential threat to the unity of the country began to dominate the public media, the theme emphasized Canadian future. As other political and social issues began to dominate the press, however, they too were manifested as themes in the messages.

There has also been evidence of nonspecific effects that do not involve only the temporoparietal cortices and limbic regions. Exposures to complex, weak magnetic fields at intensities of about 1 microT, particularly when they are pulsed approximately every 4 sec., are sufficient to produce opiate-like effects in humans and antinociception in rodents (Fleming, Persinger, & Koren, 1994). Direct measurements of fluctuations up to 2 microT within an adjacent magnetite mine, with no power lines in the vicinity, strongly suggest

a local source for time-varying magnetic fields which pulse with irregular patterns and intermittently approximately every 1 to 10 sec.

Direct whole-body exposure to these interstimulus intervals might explain the "peacefulness" and bliss reported by the average experient as well as the "trance" or "drugged" state putatively displayed by individuals who leave the area. In our experiments these postexposure effects are so frequent that we have included an item on the exit questionnaire to discern whether the participant should drive. Such opiate-like effects would certainly explain the proclivity for some individuals to return. Novel interactions between these fields and conditions generated by the close proximity of hundreds of human semiconductors whose brains are activated in a similar manner given shared expectation and belief cannot be excluded.

The generation of other "biogenic patterns" that evoke specific biological responses, such as alterations in fertility, would be expected. From a less optimal perspective, such repeated exposures to these complex fields or the alterations in brain chemistry associated with their exposure might affect cell division (Goodman, Bassett, & Henderson, 1983). Whether the ambient stimuli promoted the tumours in people who frequently visited or lived on the site or the neuroelectrical alterations secondary to the tumours enhanced their sensitivity to the ambient stimuli is not clear.

Opiate agonists are known to encourage proliferation of metastatic tumours (Simon & Arbo, 1986) and suppression of melatonin, an oncostatic compound, by weak pulsed magnetic fields has been shown experimentally (Lerchl, Honaka, & Reiter, 1991). It may be relevant that two of the three children who were proximal repeatedly to the Fatima (Portugal) displays in 1917, one of the five young people who reported the Medjugorje phenomena, and one of the four women at Marmora developed tumours. Depending upon the type of tumour, however, the rebound immunofacilitation (Missaghi, Richards, & Persinger, 1992) associated with intermittent exposures to these periods of suppression might also attenuate the growth of aberrant mitosis. These changes could be construed as miracle "cures."

The cultural significance of these phenomena will in large part be influenced by their sociopolitical interpretations. The Medjugorje phenomena, which had been linked to the Marmora events by one of the primary promoters of this site, was considered a portend of the civil war in Yugoslavia. Like the phenomena in Zeitoun (Cairo), Egypt, the Medjugorje events were interpreted by antagonistic sociopolitical groups as proofs of their own beliefs and convictions. Religious beliefs often affect behaviors and serve as rationale for their often serious outcomes. If the experiences within "religious sites" are due to natural forces from the earth itself, exacerbated by the focus of complex electromagnetic patterns generated by modern technol-

ogy, then the precise mechanisms by which these energies are created and how they affect the human brain deserve scientific attention.

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Accepted September 20, 2001.